

# COVIRABIO

## *Company Presentation*



***Marko Poglitsch, PhD***  
*Lead Scientific Advisor & Co-Founder*



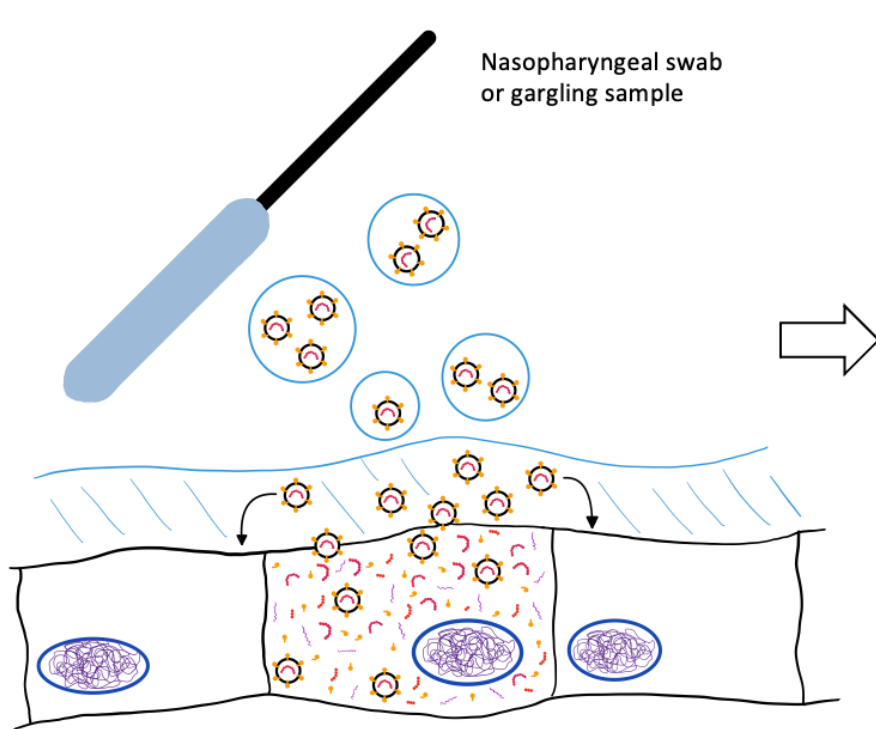
***Bernhard Klemen***  
*CEO & Co-Founder*

***5<sup>th</sup> BioNanoNet Member Welcome Webinar***

***May 25<sup>th</sup> 2023***



# Quarantine and Innovation...



Infected cells of the respiratory epithelium shed virus particles that can infect other individuals via carry over of saliva and aerosol droplets. Samples are obtained via a nasopharyngeal swab or gargling with saline solution.

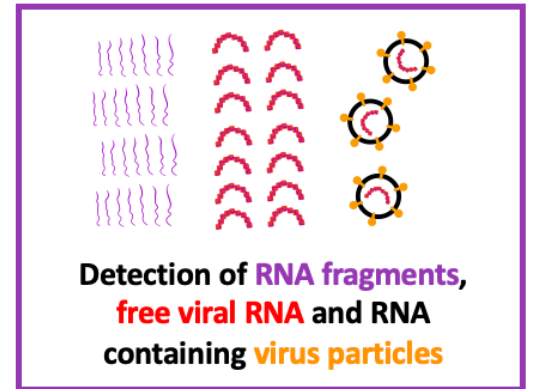


## Complex samples:

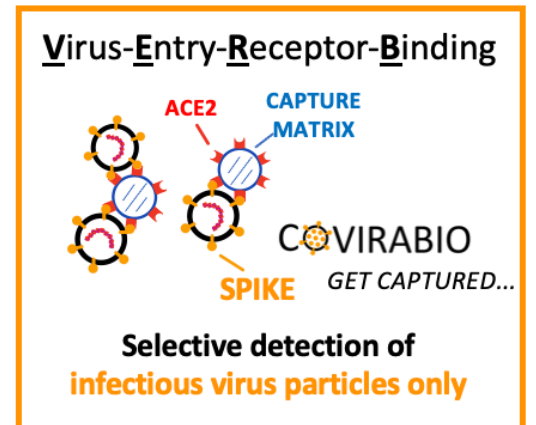
- Epithelial cells
- Cell fragments and mucus
- Virus proteins and fragments
- Free genomic viral RNA
- Intracellular viral mRNAs
- Infectious virus particles



## CLASSIC RT-PCR



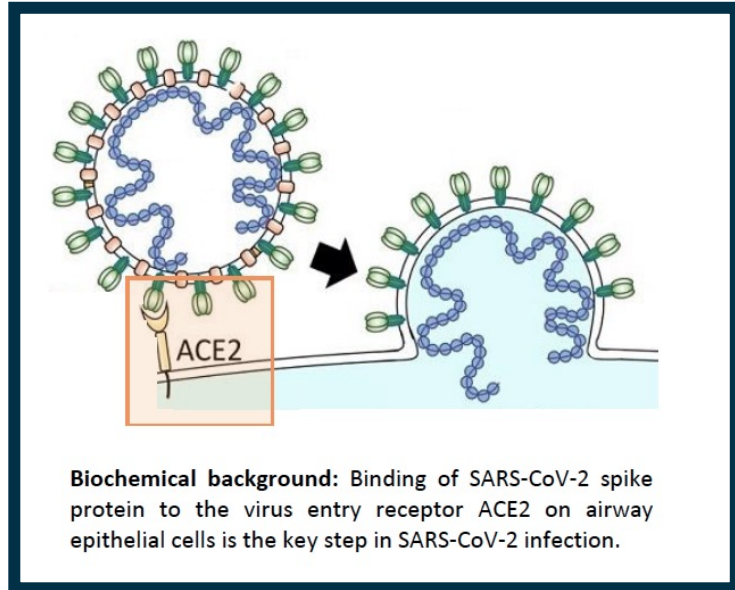
## VERB-ASSAY



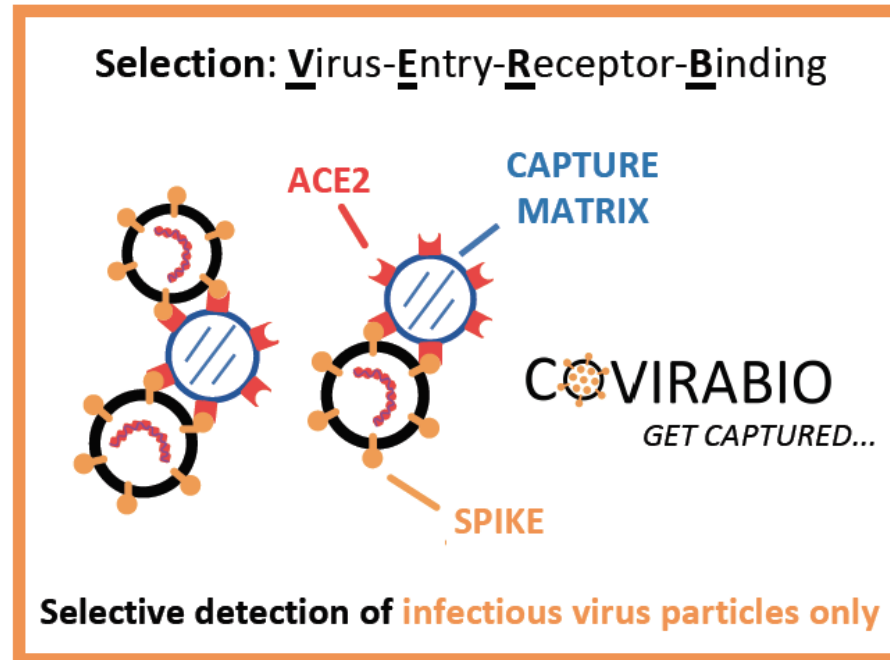


# VERB-Approach: Virus Entry Receptor Binding

## NATURAL INFECTION EVENT



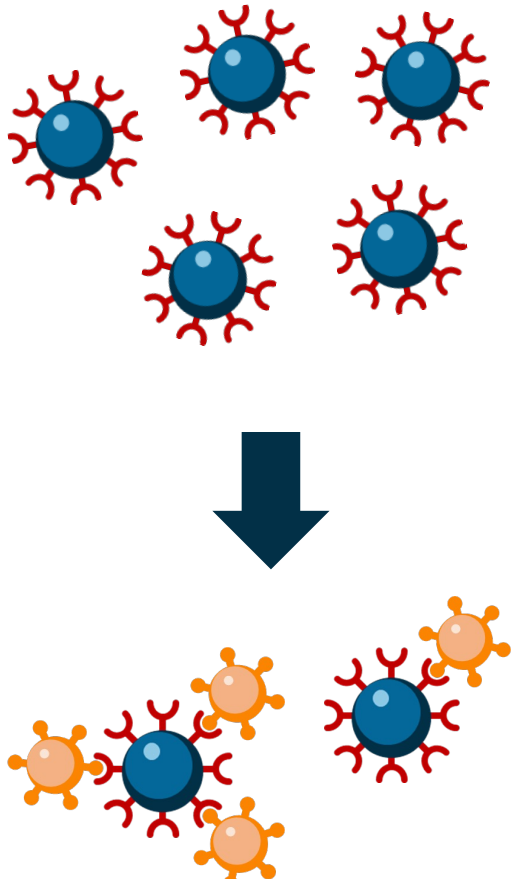
## VERB-ASSAY



Spike

ACE2

# VERB-Approach: Proof-of-Concept Model SARS-CoV-2



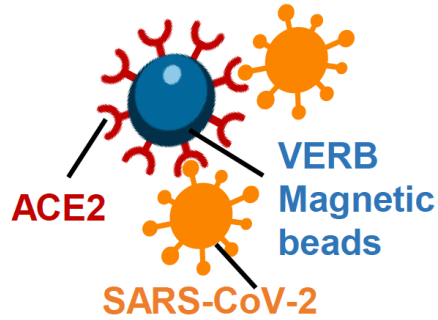
- Detection of **INTACT VIRUS PARTICLES ONLY**
- Sample material: swabs, body fluids
- Multiple detection options
  - + *Colorimetric / Fluorimetric*
  - + *(RT-q)PCR*
  - + *SPR (Surface-Plasmon-Resonance)*
  - + *Biosensors*
  - + *Microfluidics*
- Completed p.o.c. in COVID-19 (PFU vs. VERB)

Spike

ACE2

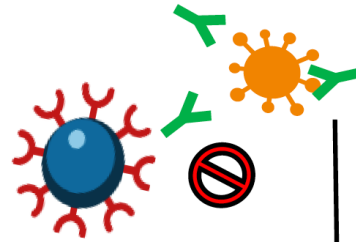
# SARS-CoV-2 VERB Kit

## Isolation of intact SARS-CoV-2 virus from patient samples



- Enriching SARS-CoV-2 viral particles
- Isolating SARS-CoV-2 viral genome
- Enhancing RT-PCR and LAMP performance
- Isolation of ACE2-interacting molecules
- Isolation of soluble spike proteins

## Detect the presence of SARS-CoV-2 neutralizing antibodies



### Neutralizing antibodies

- Determining viral neutralizing titers
- Immune response to variants of concern
- Vaccine efficiency monitoring
- Screening for SARS-CoV-2 viral entry inhibitors



**Virus Entry Receptor Binding – VERB assay (RUO)**  
A simple tool to isolate intact SARS-CoV-2 particles and detect the presence of neutralizing antibodies

## Assay Principle

The highly efficient binding of SARS-CoV-2 via its spike protein to its cellular entry receptor ACE2 is the basis for the successful initiation of the infection cycle of this virus and forms the molecular principle of the VERB (Virus Entry Receptor Binding) approach developed by Covirabio. A capture matrix has been developed which allows the highly efficient isolation of intact SARS-CoV-2 particles and the determination of the presence of neutralizing antibodies in a routine lab environment.

The VERB assay is a stand-alone sample preparation method compatible with downstream detection methods such as RT-qPCR and thus can be easily integrated into existing laboratory procedures.

## Procedures

- **Add VERB beads**  
Nasal swab, Serum
  - **Viral capture**  
≤ 30 min
  - **Viral RNA extracted**
- Automatic mode (e.g. Maelstrom and King Fisher systems) for medium and high throughput
  - Manual mode for low sample numbers

## Performance

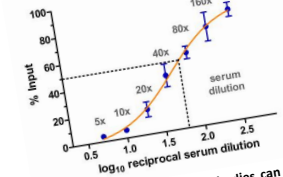
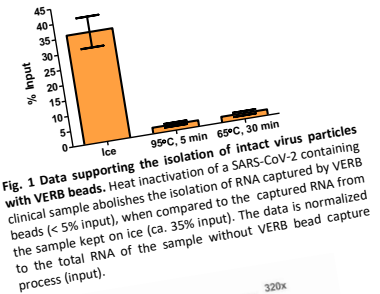


Fig. 2 Presence of neutralizing antibodies can be detected with the VERB beads. Reference serum with neutralizing antibodies against SARS-CoV-2 (EURM017) was serially diluted and incubated with SARS-CoV-2 pseudovirus before submission to the VERB assay. The titer of neutralizing antibodies was determined how much RNA captured by VERB beads. The  $IC_{50}$  determined by VERB was at 47.3.

## Applications

Numerous publications and recent research highlight the potential applications of harnessing interactions between ACE2 and spike proteins for COVID-19 research, such as, but not limited to:

### Isolation of intact SARS-CoV-2 virus from patient samples

- Enriching SARS-CoV-2 viral particles
- Isolating SARS-CoV-2 viral genome
- Enhancing RT-PCR and LAMP performance
- Isolation of ACE2-interacting molecules
- Isolation of soluble spike proteins

### Detect the presence of SARS-CoV-2 neutralizing antibodies

- Determining viral neutralizing titers
- Immune response to variants of concern
- Vaccine efficiency monitoring
- Screening for SARS-CoV-2 viral entry inhibitors

## Key Features

Characteristics	<ul style="list-style-type: none"> <li>• Capture and enrich only intact virus from patient samples</li> <li>• Free of viral RNA fragments and debris</li> <li>• Comparable to the labor-intensive viral plaque assay</li> </ul>
Components	<ul style="list-style-type: none"> <li>• Magnetic beads functionalized with recombinant human ACE2</li> </ul>

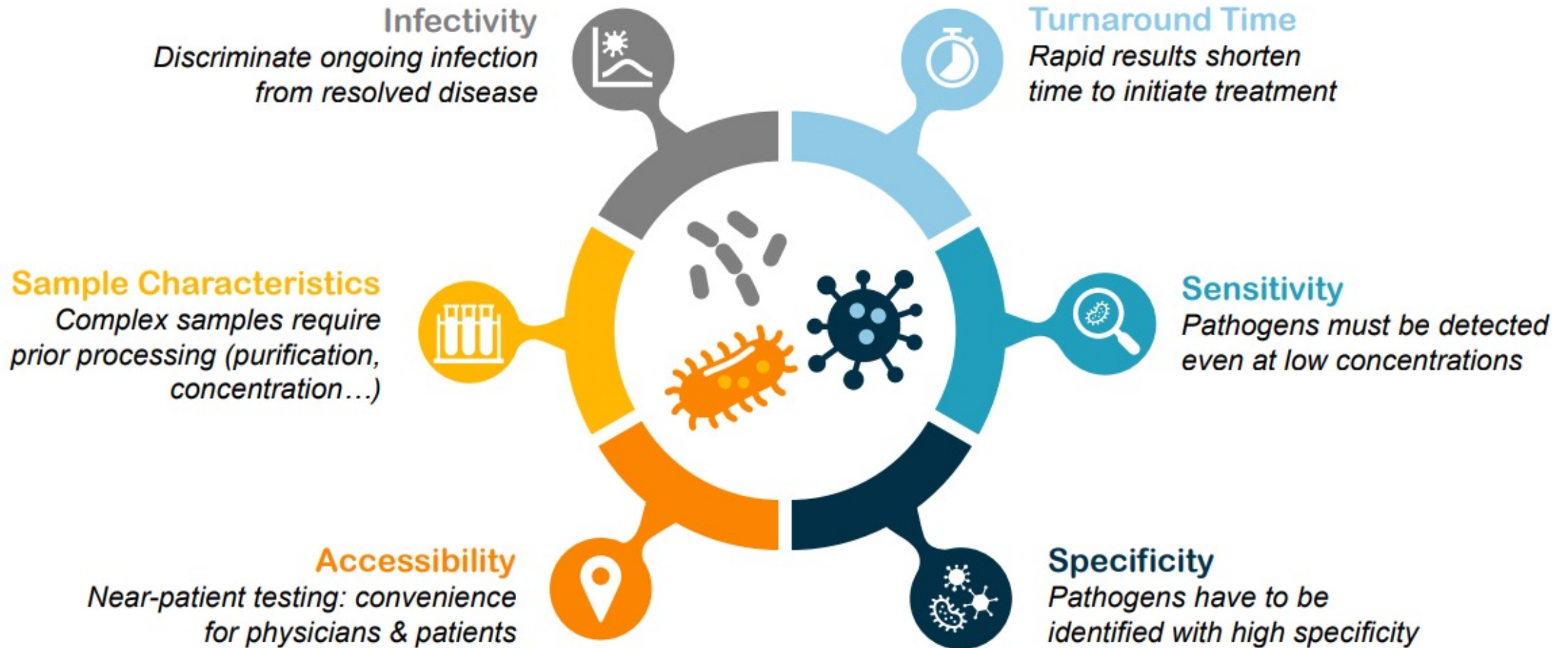
Order information  
Cat. COV007-RUO

**COVIRABIO**

Further information  
info@covirabio.com



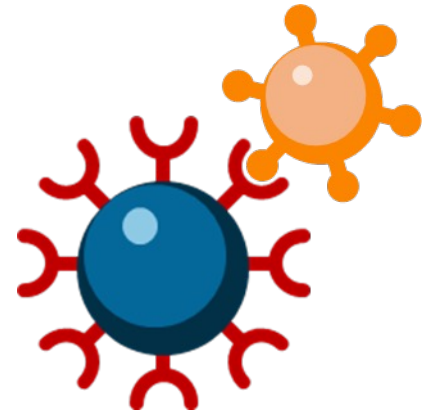
# Challenges in the Diagnosis of Infectious Diseases



# MISSION

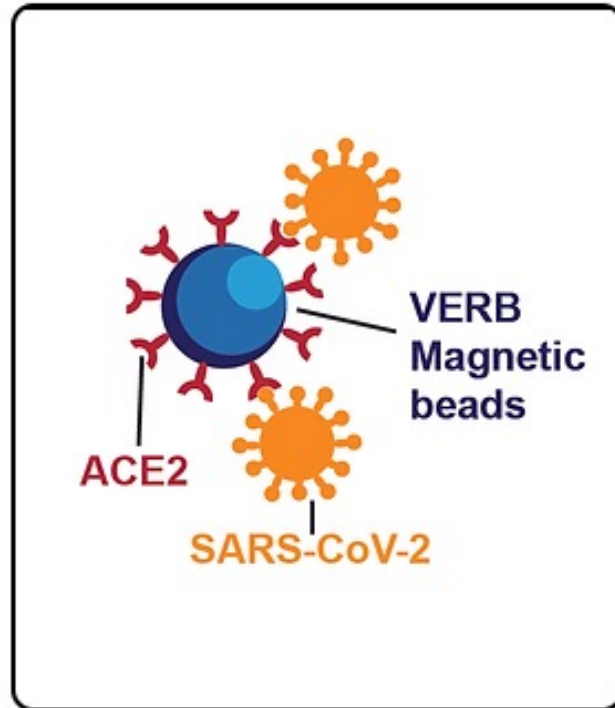
## *Diagnostic Utilization of Host-Pathogen Interactions*

- identify **specific and immune-relevant** host/pathogen interactions
- develop novel highly sensitive **nanoparticle-based diagnostic tools**
- implement **emerging technologies** to develop **improved and affordable diagnostic solutions** for pathogen detection and immunity monitoring (microfluidics, biosensors,...)
- providing robust and sensitive **pre-analytic approaches** for pathogen detection (“enrichment”)
- offer tools for **rapid and sensitive detection** of infectious respiratory viruses



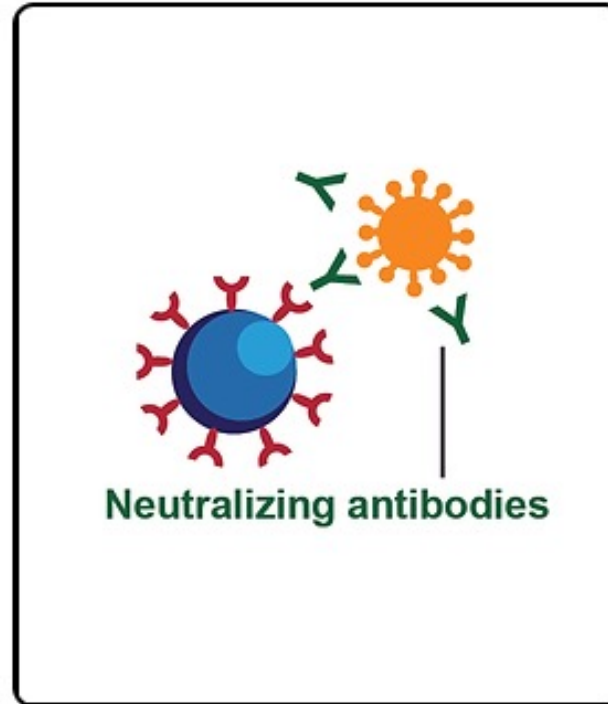
# Platform Technology: Functionalized Nanoparticles

## VERB



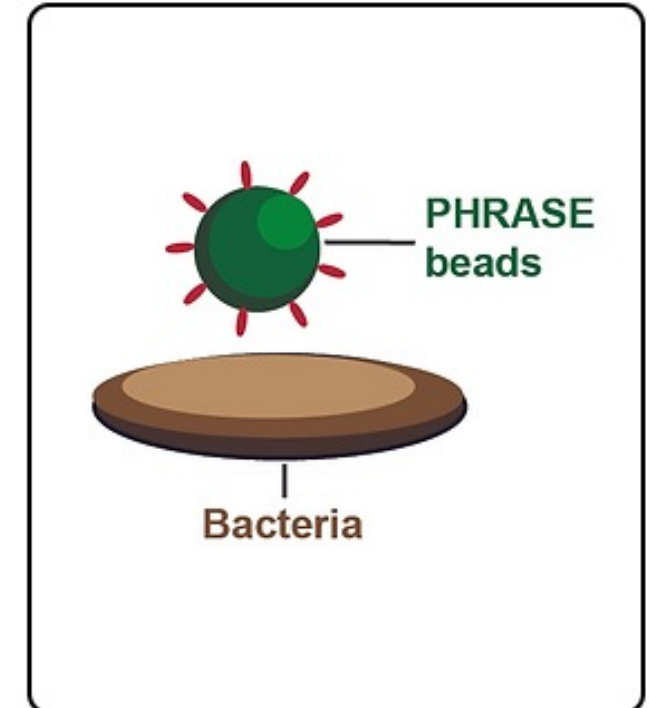
- Sample concentration
- Infectious respiratory virus detection (RT-PCR)

## IMMUNITY



- Lab-Assays (plate format)
- Microfluidics & Multiplexing
- Lateral flow devices

## PHRASE



- Concentration/Purification
- Microfluidics
- Antibigrams, CFU-Assays

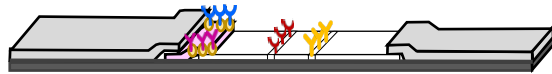


# *Immunity Monitoring: SARS-CoV-2 as a p.o.c. Model*

## *Nanoparticle based Detection of Neutralizing Antibodies*

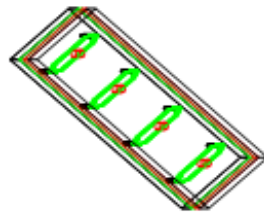
### Spike-Subtype-specific Immunity Monitoring

#### Paper-based microfluidic nAB assay



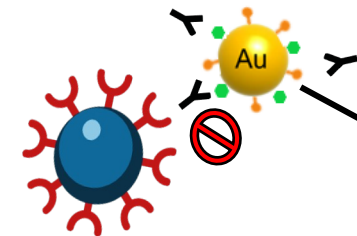
- Lab prototype ready
- Negotiations with manufacturers
- Assays for alpha and omicron variants

#### Cartridge-based Microfluidic nAB assay



- Lab prototype in finalization
- Exploration of possibilities for the device design (fluorescent reader, fluid manipulation)
- Focus on multiplexing

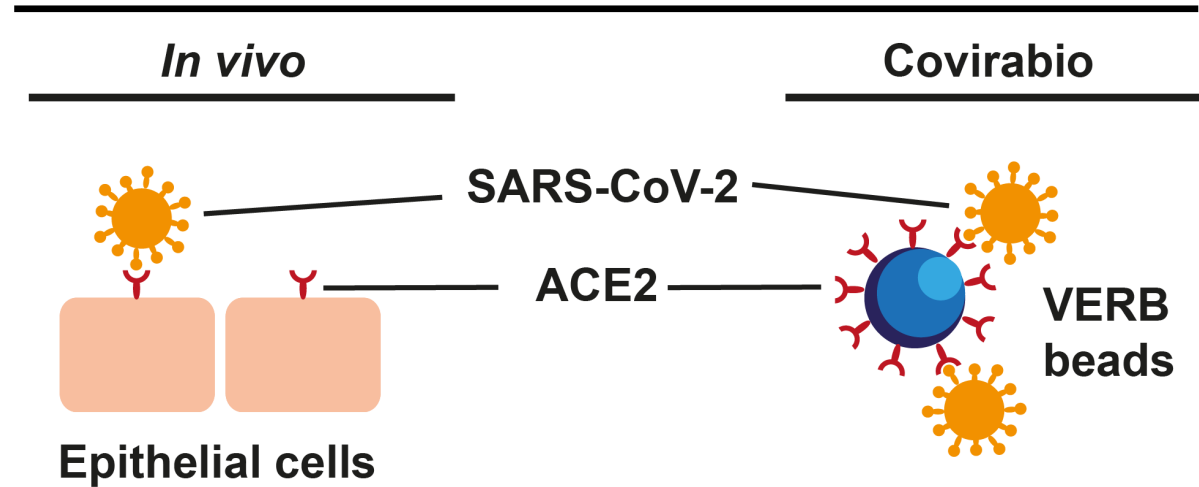
#### Lab-based VERB nAB assay (VERB-Kit)



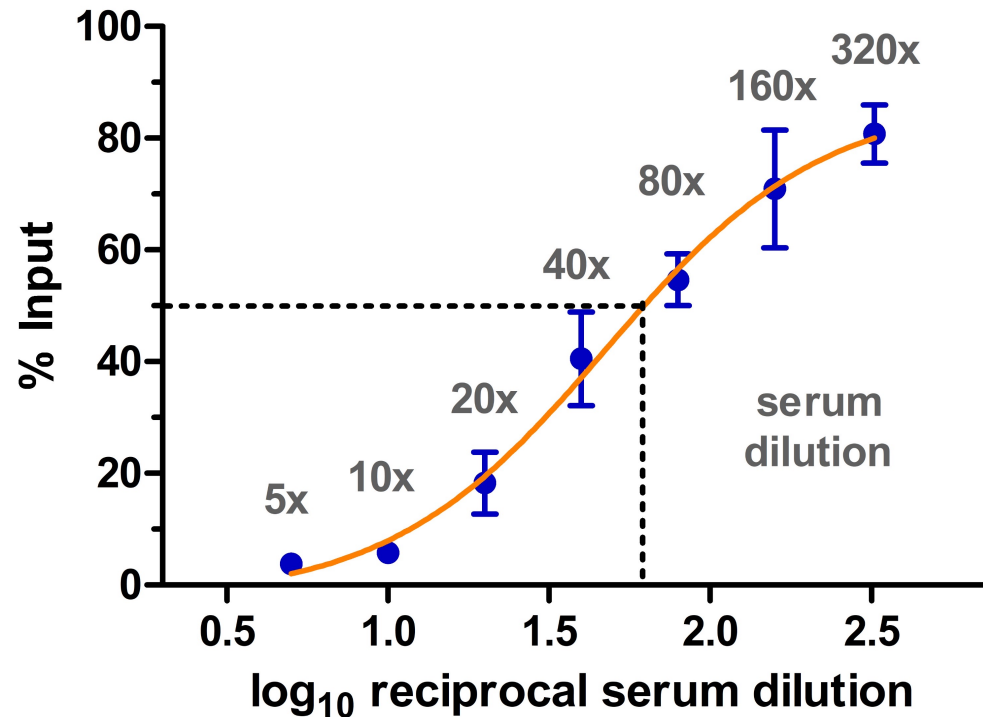
- Assay developed
- Evaluation of microfluidic nAB results
- Fast setup and easy handling
- Commercialization options are being evaluated

# SARS-CoV-2 Immunity Monitoring

## VERB Assay Virus Entry Receptor Binding



# SARS-CoV-2 Immunity Monitoring (VERB-Kit)

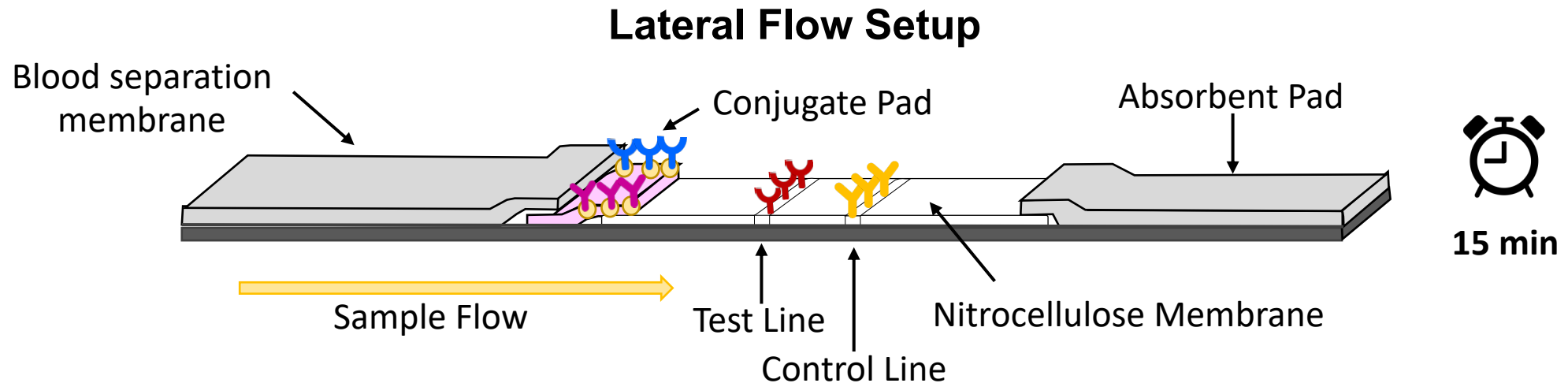


**Presence of neutralizing antibodies can be detected with the VERB beads.** Reference serum with neutralizing antibodies against SARS-CoV-2 (EURM017) was serially diluted and incubated with SARS-CoV-2 pseudovirus before subsection to the VERB assay. The titer of neutralizing antibodies was determined by how much VERB-captured RNA could be detected. The  $IC_{50}$  determined by the VERB kit was at serum dilution of 47.3.

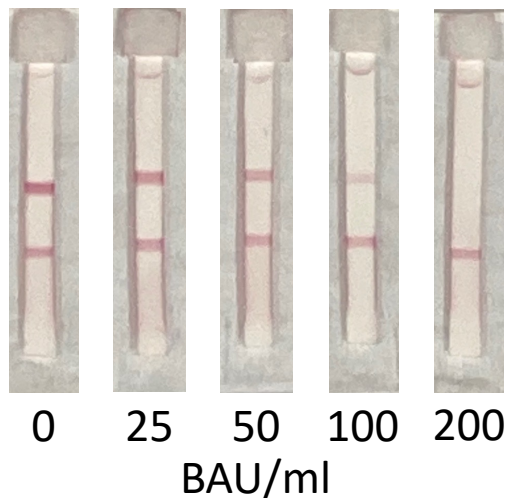


# Immunity Monitoring SARS-CoV-2

## Nanoparticle-based Detection of Neutralizing Antibodies



### Functional Lab-Prototype

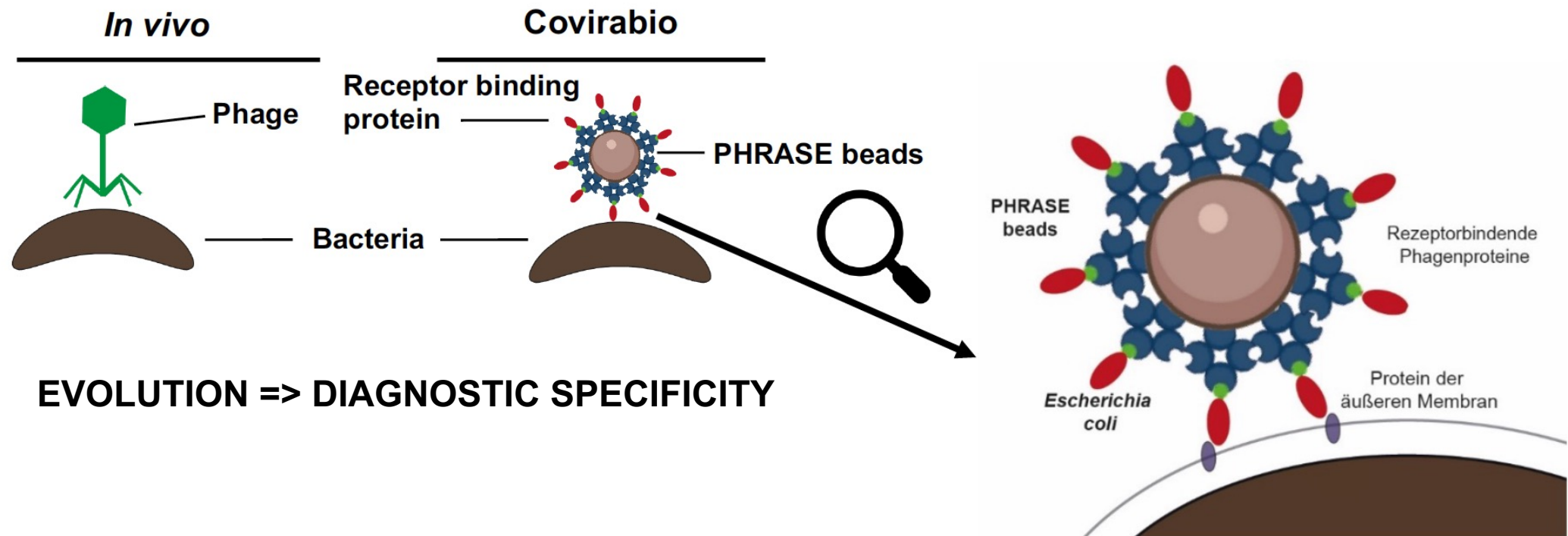


Test Line  
Control Line

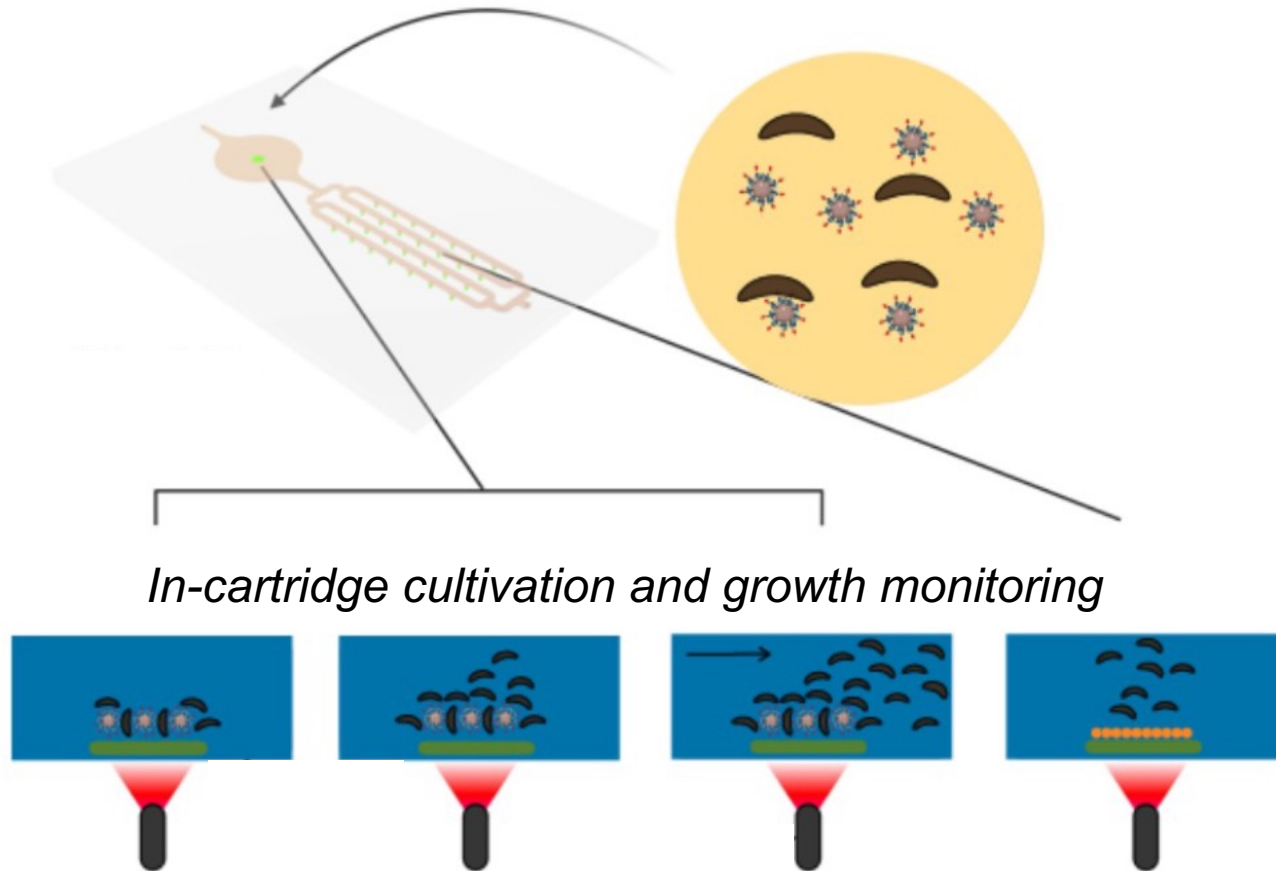
- Rapid test for immunization status against SARS-CoV-2
- Optional analysis of **whole blood** or serum
- Based on interaction of **natural receptor/ligand pairs**
- BAU sensitivity optimized for self-testing

# PHRASE Approach

## PHage-Receptor-Assisted-Sample-Enrichment



# PHRASE Microfluidics



*Microfluidic-based real-time detection of pathogenic bacteria in biological samples*

- => Qualitative Diagnostics
- => CFU-Determination
- => Antibigrams



# Team and Partners

## R&D Team



## R&D Partners



MEDICAL UNIVERSITY  
OF VIENNA

PARKER  
INSTITUTE  
for CANCER IMMUNOTHERAPY



Wiener Gesundheitsverbund  
Klinik Donaustadt



## Scientific Advisory Board Members



### Prof. Dr. Peter Ertl

- Biotechnology; Chemistry (PhD); biophysicist (postdoctoral);
- Technical University of Vienna; Berkeley (Fulbright Scholar);
- Research focus on biosensors, microfluid devices, lab-/ organ-on-a-chip technologies

## Private-Sector Partners



- Diagnostics company with 10+ year ACE2/ analytics experience
- Lab environment/ staff